



Evaluation of Continuity in Faulted Sandstone Reservoir in 'X' and 'Y' Fields, Greater Ughelli Depobelt, Niger Delta, Nigeria

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Received: 29 September 2016, Revised Received: 11 October 2016, Accepted: 18 October 2016

Abstract

Analyses carried out in this study on the subsurface sediments belonging to Fields 'X' and 'Y' in the Niger Delta Basin utilizing biostratigraphic, sequence stratigraphic tools. The objective was to understand that the reservoir sand bodies which are continuous across these fields has been hampered by problems of lateral facies changes which have led to poor predictions of sand quality and development even where good structures are existing. Therefore, it has been observed that wells located in this depobelt, in which samples for this study were provided from, experienced lots of structural deformations due to the existence of faults structure. These faults have impacted on the continuity of the sandstone bodies within this basin, thereby causing facies changes. The problems of sandstone architecture with respect to spatial distribution of lithofacies, stratal geometry and orientation had been solved by the application of biostratigraphy, sequence stratigraphy and log correlation methods with respect to the given wells used in this study. Adoption of sequence stratigraphic interpretation has given adequate clues on the existence of the Maximum Flooding Surfaces and Sequence Boundaries. After carrying out detailed biostratigraphic analysis, the key surfaces delineated in these wells were correlated to the third order cycles chart in association with chronostratigraphically significant benthic and planktic bioevents. The Maximum Flooding Surfaces are characterized by *Chiloguembelina cubensis* and/or *Globorotalia opima* (28.1Ma), *Uvigerinella sparsicostata* (31.3Ma), *Spiroplectammia wrightii* (33.0Ma) and *Hopkinsina bononiensis* (34.0Ma) were encountered and accordingly used in dating the key bounding surfaces with the aid of the Niger Delta chronostratigraphic chart. This provided a better resolution in ascertaining the respective pay zones within the wells of the zone. The application of correlation within this study helps to show good sand bodies across the five wells. Knowledge gained from this research work helps to explicate that reservoirs encountered within this depobelt is continuous in spite of the prevalent occurrences of fault structures.

Keywords: Biostratigraphy, Sequence stratigraphy, Well logs, Correlation, Continuity, Dated surfaces and Greater Ughelli depobelt.

Introduction

The identification and delineation of horizons utilizing the approach of sequence stratigraphic interpretation for wells in these fields help to show continuous reservoir strata development as all the identified candidate surfaces clearly indicate areas of delineated reservoir and non-reservoir rocks respectively. The prediction of the continuity of the strata and adoption of sequence stratigraphy in this direction involves multidisciplinary approach using correlation, well logs and biostratigraphic/biofacies datasets. The subsurface ditch cutting samples after due process normally yield biostratigraphic datasets which provide highly useful information on identifying condensed sections and their ages in million years (Maximum Flooding Surfaces and Maximum Regressive Surfaces), chronostratigraphic surfaces, paleobathymetry, paleoenvironments and climatic conditions. Wells located in the Greater Ughelli Depobelt of the Niger Delta region, in which samples for this study were taken from, however, experienced lots of structural deformations due to the existence of faults structures. These faults have impacted on the continuity of the sandstone bodies within this sedimentary terrain, thereby causing facies changes.

Results of work carried out by many scholars and multinational companies within this depobelt using sequence stratigraphic and empirical correlation techniques showed that reservoir sands encountered within the horizons are poorly developed.

This study concentrates on the identification of relative age and zonation of the sediments, stratigraphic styles and stratigraphic positions of the subsurface sediments within the analyzed wells. Foraminiferal micropaleontology and paleo-environmental analyses were limited to the biostratigraphic investigation while the detailed

lithologic descriptions of all the ditch cutting samples within the wells provided comparison with the log signatures. Correlation exercise carried out on the subsurface sediments across the wells involves horizontal mapping of the shale and sand bodies in both stratigraphic and structural orientations in order to decipher the stratigraphic positions of the sediments and their equivalences in the adjacent wells. More recent studies which involves integrated reservoir continuities have largely focused on modifications of the basic sequence stratigraphic model with the use of sophisticated software and its adoption clearly showed that depositional cycles occur as large scale within an upward-fining and coarsening succession (Zecchin et al., 2006; Kim et al., 2006; and Balogun, 2003).

In deltaic settings and in most depositional settings, sedimentation consists of stratigraphic cycles characterized primarily by alternation between more energetically and less energetically supplied materials, such as sand-shale alternations. Depositional sequence uses the subaerial unconformity and its marine correlative conformity as a composite sequence boundary. The alternative method of defining sequences and systems tracts was proposed by Finzel et al., (2009) while Schumm (1993) offered an alternative way of packaging the stratal sequences by addressing the main pitfall of the deposition and genetic stratigraphic models. However, Embry (2002) and Galloway (1989) gave descriptions of detailed specific aspects of depositional sequences in which the correlative conformity is either picked as the sea floor at the onset of forced regression or sea floor at the end of forced regression. All these postulations lead to the exploitation and discovery of oil through the understanding of structural traps and the nature of the sediments continuity which enhances such discoveries.

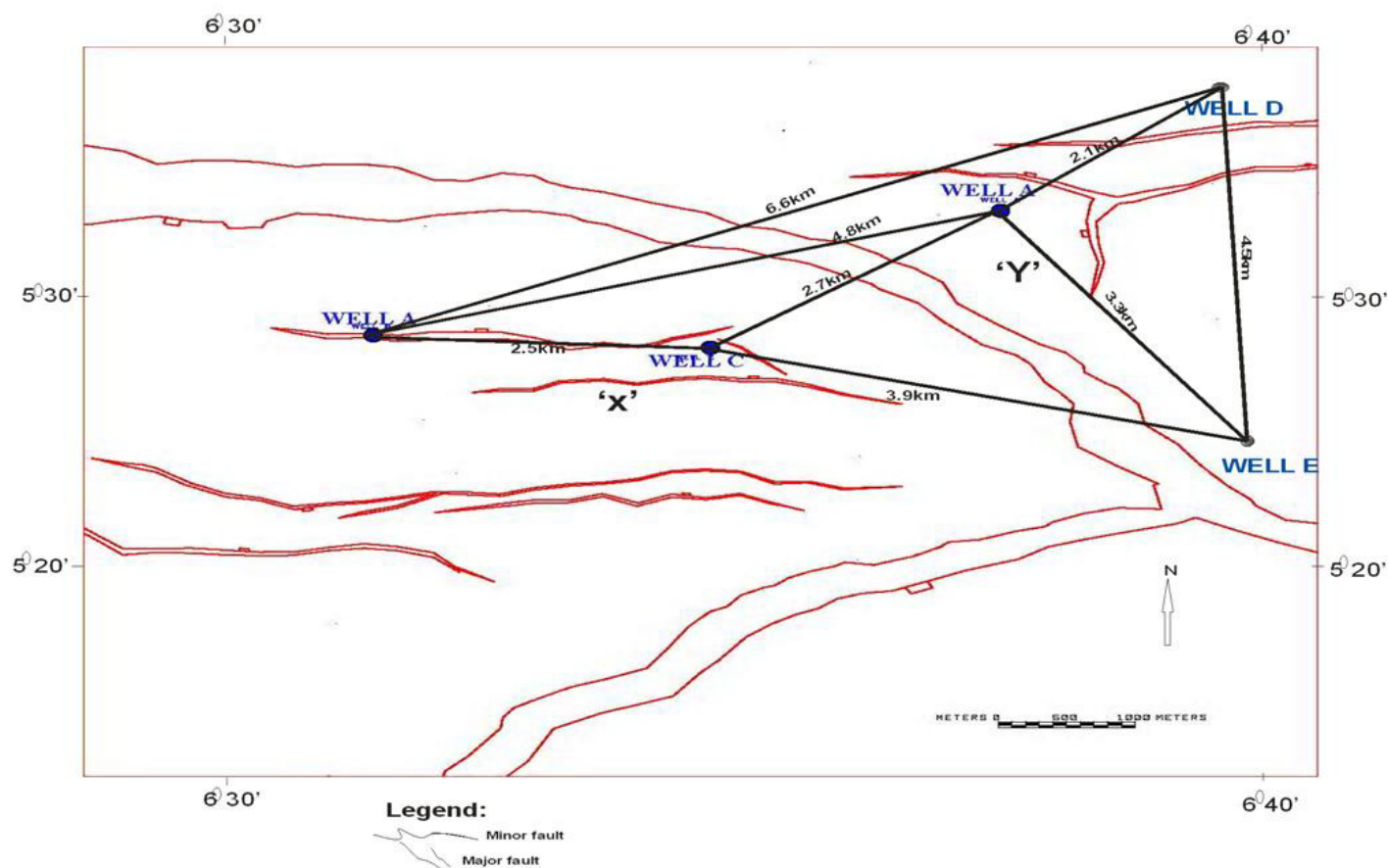


Fig.1. Wells location and their distances within the two Fields in the Central Niger Delta.

Objectives

1. Carrying out detailed foraminiferal biostratigraphic analysis of wells 'B' 'D' and 'E'.
2. Integrating and analyzing biostratigraphic and composite well logs (Gamma and Resistivity log motifs) datasets.
3. Undertakes detailed correlation using all the encountered microzones and the candidate surfaces.
4. Erect a sequence stratigraphic framework of the study area.

General Geology of the Niger Delta

Fields 'X' and 'Y' (Fig. 1) is located in the Greater Ughelli depobelt of the Niger Delta basin, however extensive literature review and several paper presentations on these fields and their adjoining areas

within the Niger delta have been documented by scholars and oil companies working within this environment. The Niger Delta is located at the southern end of Nigeria where it is bordered by the Atlantic Ocean and extends from longitudes 3° - 9°E and latitudes 4°30' - 5°20'N and has been described as a clastic example of continental- margin with collapsed structure under sediment loading on the passive western margin of Africa (Khalivov and Kerimov, 1983 and Edwards, 2000). The Benin hinged line and Calabar Flanks mark the north-western and eastern boundaries of the Delta respectively. It is bounded in the north by the Anambra basin and the Abakiliki high, and the south by the Gulf of Guinea.

Sedimentation in the basin commenced in the Late Paleocene/Eocene when the sediments began to build

out beyond the troughs between the basement horst blocks at the northern flank of the present delta area. The subsurface lithostratigraphic succession of the Niger Delta consists of three diachronous units namely, Akata, Agbada, and Benin Formations (Table 1) and their age ranges from Eocene to Recent (Ekweozor, and Daukoru, 1992; Bustin, 1988). The Akata Formation, at the base, estimated to be up to 7000m thick, believed to be of open marine and prodelta in origin and it is made up of thick marine shale sediments (Doust, and Omatsola, 1990). The formation is typically over-pressured and ranges in age from Eocene to Recent (Avbovbo, 1978). The Akata Formation is overlain by the paralic sediments of the Agbada Formation. It is characterized by alternating sandstones and shales deposit that represent cyclic coarsening upwards regressive succession sequence resulting from distributary channel migration and abandonment (Weber and Daukoru, 1988).

Table 1. Lithofacies scheme for the Niger Delta
(After Stacher, 1995)

FORMATION	LITHOLOGY		
	Sand (%)	Shale (%)	Ratio
Benin	90	10	9 : 1
Agbada	60	40	3 : 2
Akata	20	80	1 : 4

The strata within this setting are interpreted to have been deposited in fluvio-deltaic environments between the Eocene to Recent times (Stacher, 1995). The Benin Formation on the other hand, comprises of the top part of the Niger Delta clastic wedge and is therefore made up of massive, highly porous, fresh-water bearing sandstones, with local thin shale

interbeds considered to be of braided stream origin. The age of the formation is estimated to range from Eocene to Recent.

Five major depobelts defined by syn-sedimentary faulting that occurred in response to variable rates of subsidence and sediment supply are generally recognized in the Niger delta. These are the Northern Delta (Late Eocene-Middle Miocene), Central Swamp I and II Early Miocene- Middle Miocene), Coastal Swamp I and II (Middle -Late Miocene) and Offshore depobelt (Late Miocene - Pliocene). The interplay of subsidence and sediments supply rates however resulted in the deposition of discrete depobelts, each with its own sedimentation, deformation and petroleum history. These depobelts are 30-60 km wide and prograde southwestward with probably 250 km over Oceanic crust into the Gulf of Guinea.

Hydrocarbon in the Niger Delta is produced from sandstone and unconsolidated sand deposits, predominantly in the Agbada Formation. Known reservoir rocks are Eocene to Pliocene in age and are often stacked. According to their possessed reservoir geometry and quality, the most important reservoir quality or types are described as point bars of distributary channels and coastal barrier bars intermittently cut by sand-filled channels (Kulke, 1995). However, turbiditic sands deposits encountered within the lower part of Akata Formation are potential targets in deep-water Offshore and possibly beneath currently producing intervals onshore. Source rocks in the Niger-Delta might include interbedded heterolithic and shales sediments of the Agbada Formation and the marine Akata Formation shales (Evamy et al., 1978). Structural traps formed during syn-sedimentary deformation of the Agbada Formation (Stacher, 1995) and stratigraphic traps formed preferentially along the Delta Flanks which define the most common reservoir locations within the Niger Delta complex.

The primary seal rocks are interbedded shales within the Agbada Formation due to clay smears along faults, interbedded sealing units juxtaposed against reservoir sands due to faulting and vertical seals produced by laterally continuous shale-rich strata ((Doust, and Omatsola, 1990). The continental margin off the Niger Delta is undergoing deformation by gravity tectonism caused by rapid stepwise seaward sediment progradation over a strong thickness of shale deposits (Evamy et al., 1978). The progradation of the deltaic sequence has been controlled by syn-sedimentary faults and the interplay between subsidence and sediment supply. Each depobelt contains one or more paleontologically distinct transgressive shale horizon. These transgressive shales represent interruptions in the overall regressive sequence that is probably related to sea-level rises. However, the fundamental trend consists of a stepwise building up of offlap cycles within each depobelt that gradually prograde southward. The result is a gradual increase in sand percentage up-section.

Materials and Methods:

The datasets employed in this study include ditch cutting samples from the three wells as stated below:

(i) Well-‘B’: 139 ditch cutting samples (1766 – 3974m), (ii) Well -‘D’: 250 ditch cutting samples (2000 – 4000m) and (iii) Well-‘E’: 254 ditch cutting samples (1800 – 4317m). Wells-‘A’ and ‘C’ were not provided with ditch cutting samples for biostratigraphic studies. However, Gamma ray, Deep induction resistivity, Neutron-Porosity, Density and Sonic well logs (covering all the five wells), location map and Niger Delta chronostratigraphic chart were also provided for this research.

Methodology

Various approaches were employed in this study and different depositional facies were identified based on

the distribution of sand, shale and sedimentary structures.

Sample Preparation for Foraminiferal Biostratigraphy

The preparatory technique used for the foraminiferal biostratigraphic sample preparation for all the three wells (‘B’, ‘D’ and ‘E’) in this study followed the approach adopted by Armstrong and Brasier (2005). A total of six hundred and forty three (643) ditch cutting samples composited at 10m and 8m from the three wells (well-‘B’ - 139 samples, well-‘D’- 250 samples and well-‘E’- 254 samples) were analyzed for foraminiferal biostratigraphy in this study.

The conventional approach for the processing of samples for foraminiferal biostratigraphy was employed. The ditch cutting samples were packed in envelopes with codes showing retrieved depths and were later rinsed to remove drilling mud and then dried. A standard weight (20 grams) of each dried sample was soaked with one teaspoonful of anhydrous sodium carbonate in water for thorough disintegration overnight. The disaggregated samples were then washed through tap water over a 63-micrometer (μm) mesh-sieve. The washed residue were then dried over a hotplate at a minimum temperature of 20⁰C and then sieved into coarse, medium and fine fractions respectively. The dried residues were then stored into well labeled sample bag. Picking was done with the aid of a picking tray and a stable hair paint brush (N00) under binocular microscope. Identification of the foraminiferal taxa was made possible with the taxonomic schemes of Petters (1979) and other relevant recent publications found useful within in the Niger delta region.

Wireline Logs

Gamma ray and Deep Induction Resistivity wireline log signatures were preferably and particularly used

for the interpretation of the sequence stratigraphic framework. However, the afore-mentioned logs were also used alongside Neutron-Porosity, Density and Sonic wireline logs to identify reservoir and non-reservoir rocks respectively. The arrangement of the wells was fixed according to their positions and their placements on the base map and/or location in order to follow the corresponding reservoir sand body across the wells. Correlation of all the wells was carried out using gamma ray and resistivity log signatures devoid of other logs because of the selection of the software used. The sand bodies and the shale counterparts were observed on these logs to ascertain the possible horizons of hydrocarbon bearing zones.

After the identification of the respective sequences and system tracts using foraminiferal assemblages and the bio-events in each well, it was marked on log data and then correlated across the other wells. This has offered grounds for the recognition of the sand bodies and the extent of their continuity.

Results and Interpretation

Lithostratigraphic Deductions from Wells

The sediments of well-‘B’ penetrated the Benin Formation (interval 1766 – 2180m) as observed apparently from the deep induction resistivity log signatures that kicks to the right while the Agbada Formation (interval 2180 – 3974m) are made up of paralic development of sands and shales (with silt intercalations) as shown in the lithostratigraphic column (Table 2). Inference drawn from sediments of well-‘B’ showed that the deposits are characterized by fine to coarse and sometimes pebbly grained sands, sandstones, shales with silt/siltstones intercalations. The table below shows the lithostratigraphic penetration of the subsurface sediments of the well together with the summary of the major sedimentological unit identified.

Table 2. Lithostratigraphic interpretation of well-‘B’.

DEPTH (m)	LITHOLOGY	LITHOSTRATIGRAPHY
1766 - 2180	Predominantly sand /sandstone with intercalation of minor shales.	BENIN FORMATION
2180 - 2350	Predominantly sand and shale with sandstone intercalations.	AGBADA FORMATION
2350 - 2500	Predominantly sand and silt with shale interbeddings.	
2500 - 2800	Predominantly shale and sand intercalations.	
2800 - 3970	Predominantly shale/sand with silt intercalations.	

Table 3. Lithostratigraphic interpretation of well-‘D’.

DEPTH (m)	LITHOLOGY	LITHOSTRATIGRAPHY
2000 - 2250	Predominantly shale/sand with intercalation of sandstone.	AGBADA FORMATION
2250 - 2700	Predominantly shale and sand intercalations.	
2700 - 3250	Predominantly sand and shale with silt intercalations.	
3250 - 3820	Predominantly shale/ sand with silt intercalations.	
3820 - 4000	Predominantly sand/shale with silt intercalations.	

Sediments of the well-‘D’ (interval 2000 – 4000m) under this study penetrated the Agbada Formation as observed from the paralic development of sands and shales (with silt intercalations) occurrences. Table 3 showed the lithostratigraphic interpretation of this well. However, inference drawn from sediments of

well-‘D’ showed that the deposits are characterized by sands, shales, sandstones and silt/siltstones intercalations. The summary of the major sedimentological unit encountered in well-‘D’ is highlighted in Table 3.

Sediments of the well-‘E’ (interval 1800 – 4317m) penetrated the Benin (Transition) Formation (1800 – 2280m) as depicted from the gamma ray and deep induction resistivity log signatures. The top of this depth (2280m) has been regarded as the first marine shale encountered. However, this depth coincides with the sequence boundary delineated below this depth. The encountered formation within this well consists of coarse grained sands with minor shale intercalations. The Agbada Formation (interval 2280 – 4317m) consists of paralic development of sands and shales with silt interbeddings. Table 4 unveiled the lithostratigraphic penetration of this well under study. Detailed lithologic description for the sedimentological evaluations of the sediments is highlighted therein.

Table 4. Lithostratigraphic interpretation of well - ‘E’.

DEPTH (m)		LITHOLOGY	LITHOSTRATIGRAPHY
1800 - 2660		Predominantly sand/shale with silt intercalations.	AGBADA FORMATION
2660 - 3800		Predominantly shale and sand intercalations.	
3800 - 4110		Predominantly sand/shale with silt intercalations.	
4110 - 4300		Predominantly shale/sand intercalations.	

However, all the sediment encountered in these wells are similar and seems to possess very peculiar characteristics. The sands are clean to smoky white, medium to coarse grained (sometimes pebbly in some intervals), moderately sorted, sub-angular to sub-rounded, calcareous and slightly ferruginized. This

sand body occasionally decreases in thickness towards the base of this interval. Sandstone were smoky white, fine –medium grained, well sorted, consolidated and slightly ferruginized. The shales are dark to light grey, sub-fissile to fissile, hard to moderately hard, micromicaceous and carbonaceous while silts were light grey, very fine grained and smooth. Minor siltstone and coal materials also occur.

Biostratigraphic analysis of well-‘E’ (Table 5) has been used as the reference well since it is the deepest drilled well in that field despite the fact that the rest of the wells also saw the penetrated the same age (Late Eocene - Early Oligocene age which falls within P16/17 - P18/19, P18/19 - P20 / N1, P21 / N2 and P22 / N3 foraminiferal zones). This is eminent because the foraminiferal zones embodied the respective downlap and onlap surfaces, which are the potential candidate surfaces employed in the sequence stratigraphic interpretation. The encountered foraminiferal events and datum with respect to the reference well are: FDO: *Globorotalia nana* at 2440m Single Occurrence: *Globigerinoides primordius* at 2600m FDO: *Globigerina angulicostata* at 2630m FDO: *Globorotalia opima* (28.1Ma) at 2840m (Indeterminate – P22/N3), LDO: *Globigerina angulicostata* at 3140m FDO: *Globigerina ampliapertura* & Influx of *Uvigerinella sparsicostata* (31.3Ma) and *Lenticulina grandis* at 3220m LDO: *Globorotalia opima* (32.7Ma) at 3300m LDO: *Spiroplectammina wrightii* (33.0Ma) at 3590m (Middle Oligocene-P21/N2), Single Occurrence: *Globigerina sellii* at 3790m LDO: *Hopkinsina bononiensis* (34.0Ma) at 3890m (Early Oligocene-P18/19 – P20/N1) Single Occurrences: *Nonion oyae* and *Globorotalia cerroazulensis* at 4090m and 4300m (Late Eocene – Early Oligocene).

Analyses carried out from the rest of the wells in this study equally showed the penetrated of the equivalent age range and zones observed from the reference well. This suggests that these sediments were deposited

Table 5. Digitized Biostratigraphic Summary of Well - 'E'.

Interval (m)	Stratcom Zone	Foraminiferal Zone	Age	Events (Index taxa/Comments)
1800	Barren	Barren		-Non recovery/sparse occurrences of microfuna
2180	PNDF 03			
		P22/N3	Late Oligocene	-FDO: <i>Globorotalia opima nana</i> at 2440m - Single Occurrence: <i>Globigerinoidesprimordius</i> at 2600m -FDO: <i>Globigerinaangulisuturalis</i> at 2630m - FDO: <i>Globorotalia opima opima</i> (28.1Ma) at 2840m
2840				
	PNDF 04	P21/N2	Middle Oligocene	-LDO: <i>Globigerinaangulisuturalis</i> at 3140m -FDO: <i>Globigerina ampliapertura</i> and influx of <i>Uvigerinella sparsicostata</i> (31.3Ma) and <i>Lenticulinagrandis</i> at 3220m -LDO: <i>Globorotaliaopima</i> (32.7Ma) at 3300m - -LDO: <i>Spiroplectamminawrightii</i> (33.0Ma) at 3590m
3170				
3590	PNDF 05			
3800	PNDF 06	P18/19 – P20/N1	Early Oligocene	-Single Occurrence: <i>Globigerinasellii</i> at 3790m - LDO: <i>Hopkinsina bononiensis</i> (34.0Ma) at 3890m
4050				
4090				
	PNDF 07	P18/19 – P16/17	Late Eocene – Early Oligocene	-Single Occurrence: <i>Nonion oyaе</i> at 4090m - Single Occurrence: <i>Globorotalia cerroazulensis</i> at 4300m
4317				

Note: FDO = First Downhole Occurrence and LDO = Last Downhole Occurrence (Last Appearance Datum= First Downhole Occurrence and First Appearance Datum=Last Downhole Occurrence).

Correlation, Structural and Chronostratigraphic
 within the same time frame despite all other environmental variations. Correlation of all the key chronostratigraphic horizons within these fields ('X' and 'Y') was based on

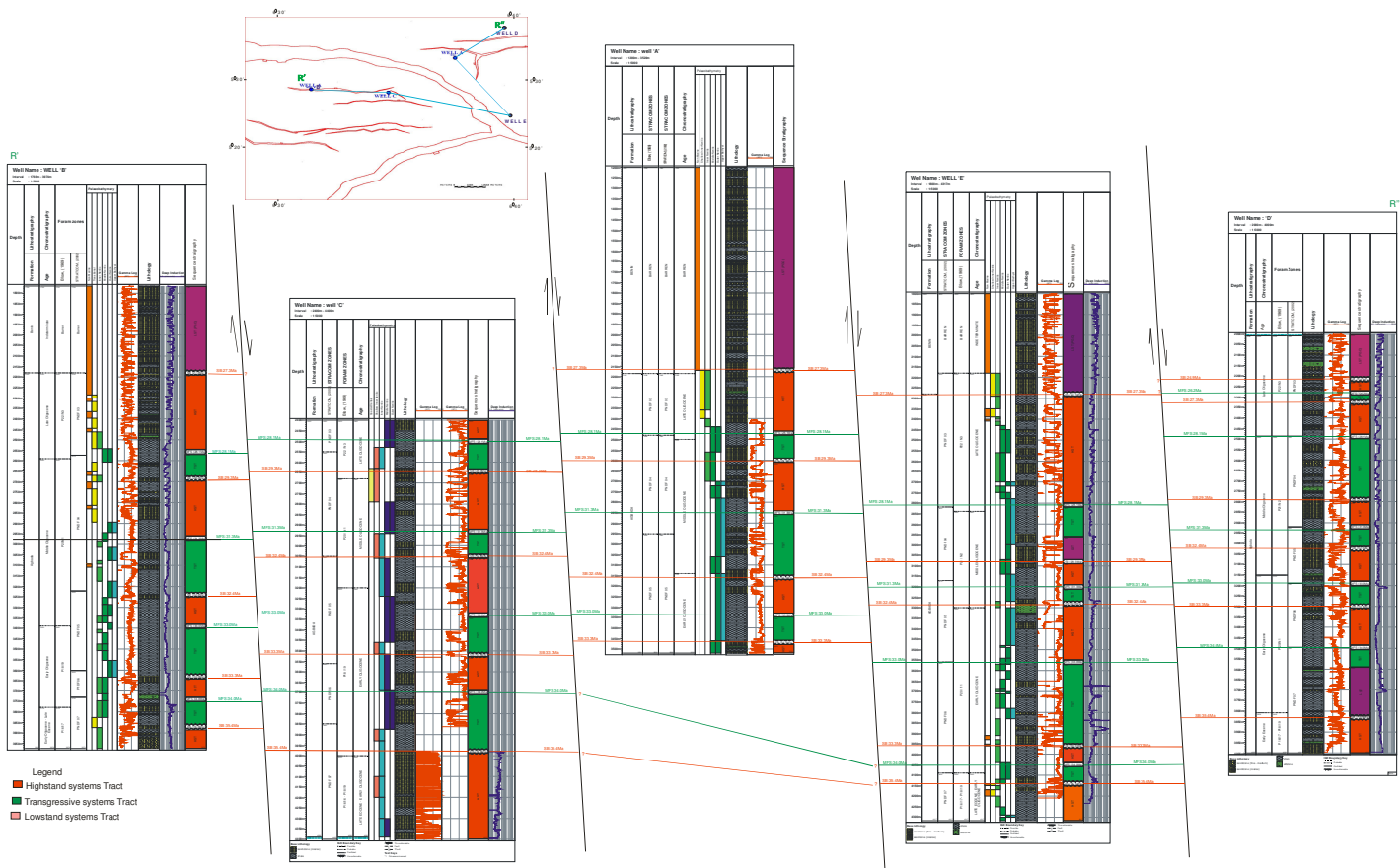


Fig. 2. Fault correlation of wells B, A, C, D and E.

biostratigraphic/ biofacies and sequence stratigraphic datasets from the five analyzed onshore wells. The well log motifs also aided the interpretation in inferring the Maximum flooding surfaces and unconformities bounding large scale successions of the wells. For the fact that they were abundant biofacies and well log datasets were excessively helpful in this exercise, therefore identification and correlation of all the key surfaces have been a success. Using the sequence stratigraphic interpretation techniques of Hernández-Mendoza et al., 2008, Van Wagoner et al., (1990) and Haq et al., (1988), a total of forty-four key surfaces (twenty maximum flooding surfaces and twenty-four sequence boundaries (although varied in the respective wells) were identified and correlated. However, from the above

number, seven inferred major maximum flooding surfaces and eight sequence boundaries were observed in wells-C and A) and this was seen to have occurred throughout the five wells (Fig. 2a). These key surfaces extend from Late Eocene (35.4Ma/Pr.3; ?Orogho Shale) to Late Oligocene (?26.2Ma/Ch.2; *Alabamina.1*) age. In addition to using paleontological data to locate stage boundaries, identification of large scale stratal stacking patterns help to discern major depositional cycles between stage boundaries and thus dividing the respective ages into regionally traceable units was equally carried out. These depositional cycles occur as large scale, upward-fining and upward-coarsening sequence successions respectively. Correlation was carried out within these wells along the strike and dip directions since they are all located in the same macrostructure (Fig. 2b & c). The

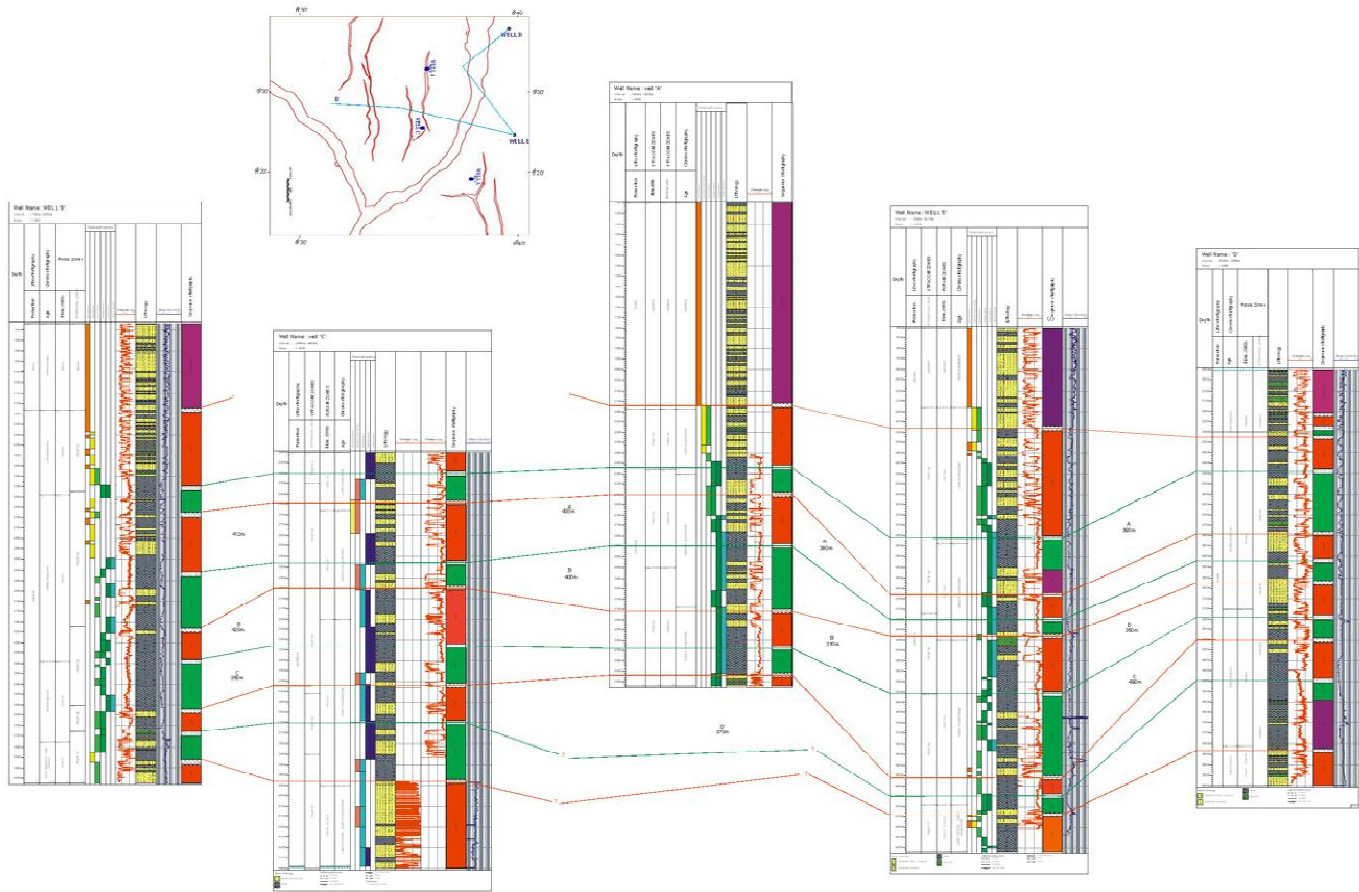


Fig. 2a. Stratigraphic correlation of wells B, A, C, D and E.

correlation of these five wells within the two fields along the strike direction showed that the juxtapositioning of wells-B, C and E exhibited a distinctive fault throw with the following average displacements, thus wells-BC - 394m with well-B on the up-throw side relative to well-C, wells-CA - 415m with well-A on the up-throw side relative to well-C, wells A-E (345m) with well -E on the down-throw side relative to well - D (Fig. 2). Furthermore, well-D, which is situated in the up-dip section showed a high fault-throw value with wells-ED of 413m average displacement relative to well - E. As a result of this, it was further deduced that wells-C and E are on the

down-throw side relative to the correlative events and surfaces encountered in wells-A, B and D respectively.

The correlation of wells-C, A and D along the dip direction showed the following datum, FDO of *Globorotalia opima* (28.1Ma), inferred (31.3Ma), LDO of *Spiroplectammia wrightii* (33.0Ma) and LDO of *Hopkinsina bononensis* (34.0Ma) which formed the basis of this correlation as well as their associated gamma ray and deep induction resistivity log signatures. These bioevents were delineated at well-C at 2500m, 2930m, 3330m and 3700m, well-A at 2470m, 2850m and 3340m and well-D at 2280m, 2488m, 2920m, 3190m and 3496m respectively.

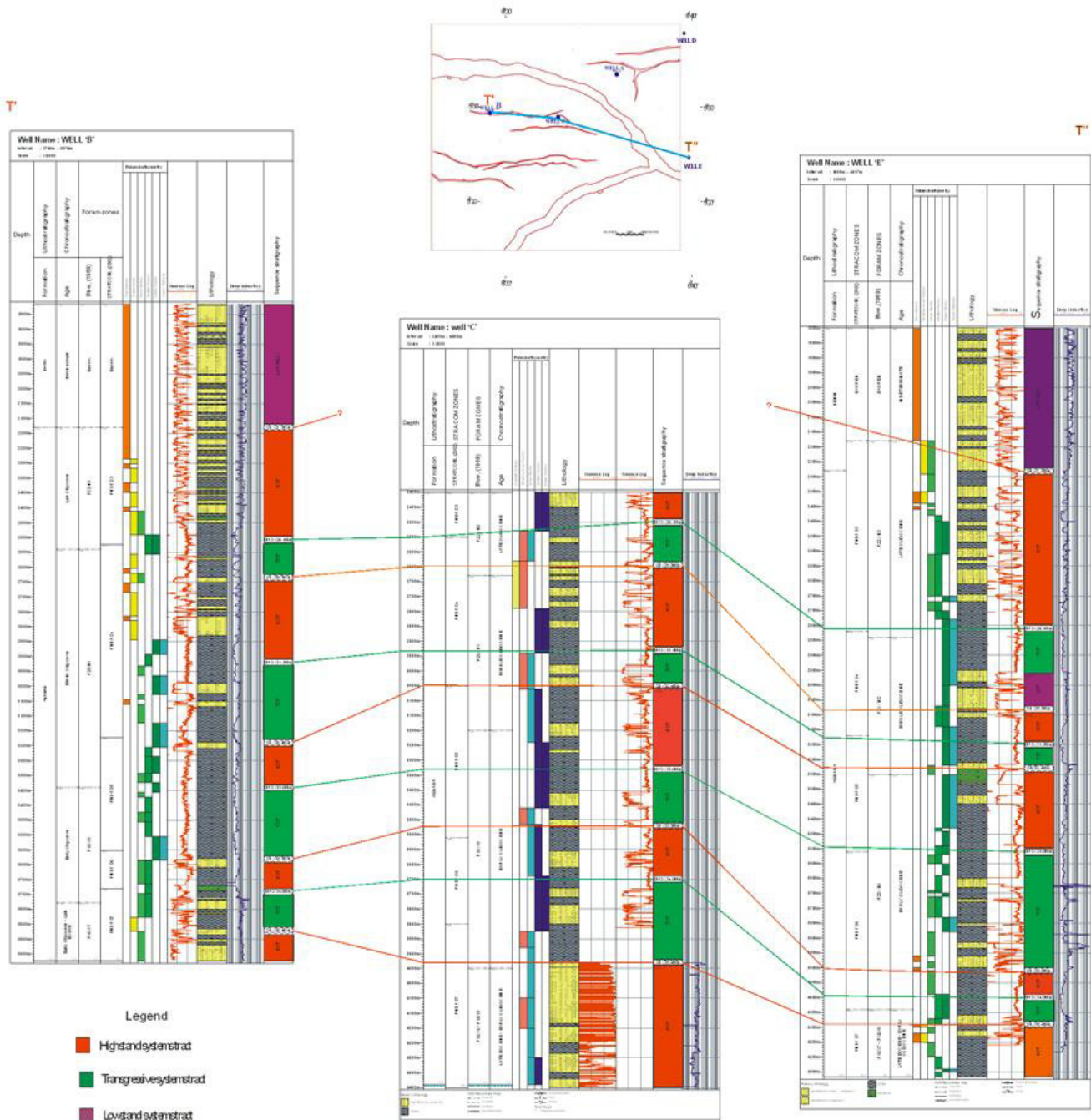


Fig. 2b. Stratigraphic correlation of wells B, C and E along the strike direction.

Wells-C and A could not attest the undefined 26.2Ma MFS bio-event as recorded in well-D. Moreover, the inferred 34.0Ma datum (LDO of *Hopkinsina bononensis*) was not encountered in well-

A. Therefore, this shows that well-A is in the up-throw block while wells-C and D are on the down-throw side relative to it. An average displacement of about 400m was observed between wells-A and C while wells-A and D showed about 435m with an

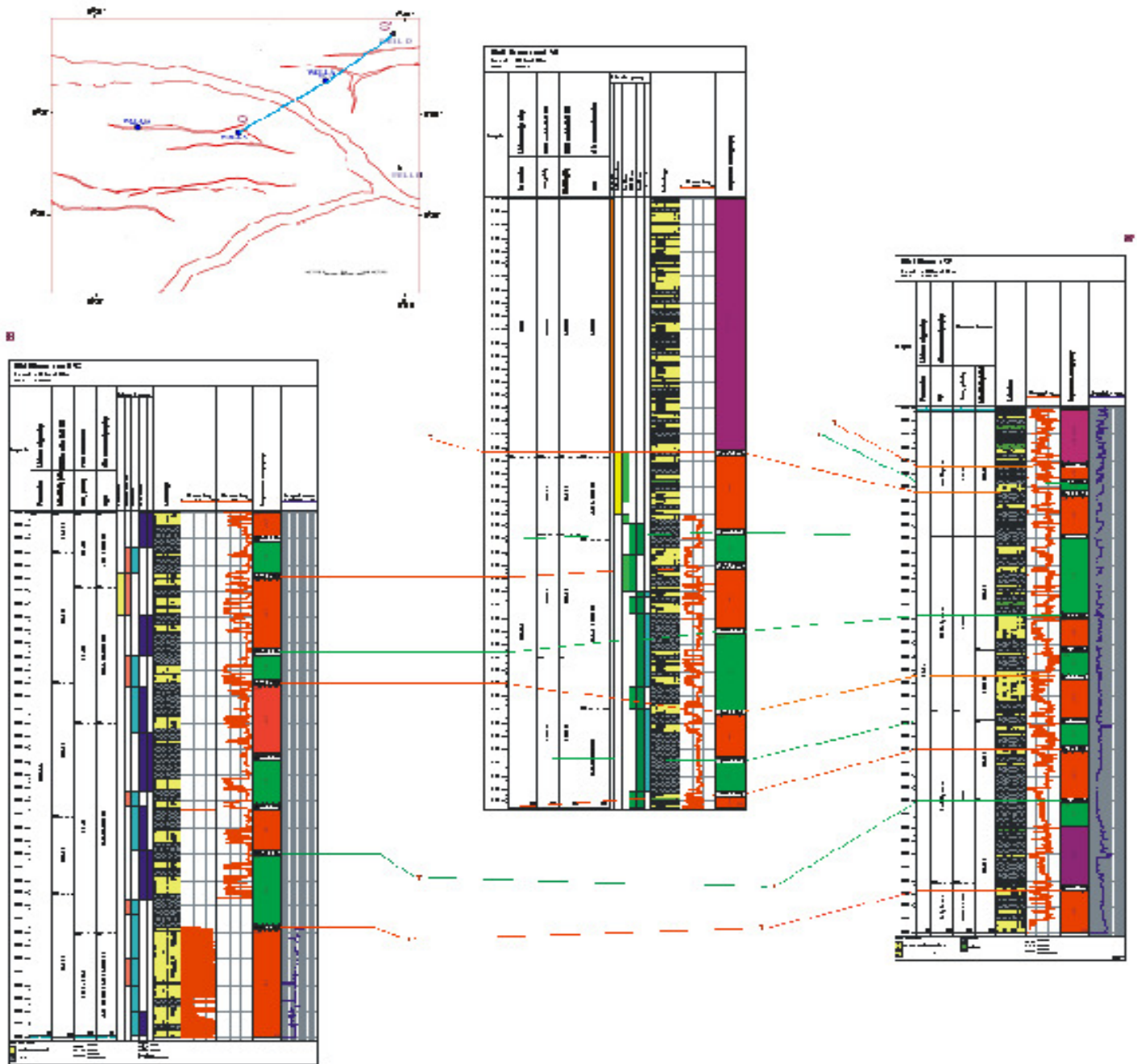


Fig. 2c. Stratigraphic correlation of wells C, A and D along dip direction.

approximated average displacement of 370m between wells-C and D at a deeper section beyond the T.D (3500m) of well-A. (Fig. 2a).

The most reliable datum in this section (A and E) was the inferred bioevents datum, FDO of *Chiloguembelina cubensis* (28.1Ma), exhibited influx

of *Uvigerinella sparsicostata* (31.3Ma) and the LDO of *Spiroplectammina wrightii* (33.0Ma) which was delineated in the two wells at 2470m, 2850m and 3340m (well-A) and 2810m, 3200m, 3560m and 6960m (well-E). It was further observed that the 34.0Ma MFS (LDO of *Hopkinsina bononensis*) bioevent encountered at 4050m in well-E was not

observed in well-A. Based on this scenario, inference could be drawn that well-A is situated on the up-throw block relative to the position of well-E with an average displacement of about 435m.

Conclusion

Biostratigraphic approach in this study has helped in elucidating the ages and zones of the analyzed wells. The delineations of the zones (P16/17 – P22/N3) and ages (Late Eocene – Late Oligocene) have been achieved by the use of the recovered benthic and planktonic foraminifera taxa from the analyzed wells. . In addition to using micropaleontological data to locate stage boundaries, stratal stacking patterns which unveiled the genetic sequences within these wells were also identified. Twenty-four sequence boundaries and twenty maximum flooding surfaces were deduced in all the five wells under study. Key surfaces were recognized based on the basis of foraminiferal peak abundance and diversities with high gamma ray and low deep induction resistivity log responses. However, these sequences show local important variations in thickness and facies. Four dated regional transgressive shale markers have been delineated in the analyzed wells. These shale markers representing the maximum transgression (MFS) are *Chiloguembelina cubensis* and/or *Globorotalia opima* (28.1Ma), *Uvigerinella sparsicostata* (31.3Ma), *Spiroplectammina wrightii* (33.0Ma) and *Hopkinsina bononiensis* (34.0Ma) which also coincide with the above mentioned time equivalent. Based on the analyses of all the datasets involved in this study, it has been observed that the reservoir sand bodies within these wells are correlable and therefore the sand bodies are continuous across the two fields of study.

Acknowledgement

The first author is very grateful to Prof. L. C. Amajor who read through this work as part of his PhD

dissertations, NAOC and University of Port Harcourt, Rivers State, Nigeria for the provision of the data used in this work and a good atmosphere to carry out this study.

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Cite this article: Udoh, M.U., Akpan, M.O., Inyang, D.O. and Tsaku, S.S. 2016. Evaluation of Continuity in Faulted Sandstone Reservoir in 'X' and 'Y' Fields, Greater Ughelli Depobelt, Niger Delta, Nigeria. International Basic and Applied Research Journal, Volume 2, Issue 10, pp. 44-58.